Aviation Investigation Final Report

Location:	Lander, Wyoming	**Accident Number:**	WPR20LA170
Date & Time:	June 7, 2020, 08:30 Local	**Registration:**	N595KF
Aircraft:	Kitfox Kitfox	**Aircraft Damage:**	Substantial
Defining Event:	Other weather encounter	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The sport pilot departed in the experimental, amateur-built airplane from a high-altitude airport with a passenger toward a mountain range. Due to the airplane's performance limitations in the high-altitude environment, the pilot was forced to circle twice as he climbed. After he entered the mountain range, he completed a circling descent to about 500 ft above ground level (agl) to overfly a lake located about 8,500 ft mean sea level (msl). The pilot then flew southwest over the lake at the planned altitude but encountered turbulence and downdrafts that forced the airplane to descend to about 25 ft agl. He applied full throttle to build airspeed and to climb, but the airplane did not climb. The pilot was forced to perform a left turn to avoid rising terrain to his right and obstacles ahead of him. However, during the maneuver, the airplane pitched up and turned left. It then immediately entered a nose-down attitude, consistent with an accelerated stall, and impacted the water.

Postaccident examination of the airframe and engine revealed no mechanical anomalies. Density altitude at the lake was about 9,500 ft. There were no charts to compute the airplane's performance at 8,500 ft mean sea level but based on the pilot's recollection of how the airplane was flying, the airplane's climb performance was likely degraded at the density altitude he was operating. Any downdrafts would have further inhibited the airplane from a climb. The pilot likely exceeded the airplane's critical angle-of-attack when he initiated a climbing left turn in such conditions.

The pilot had limited practical experience flying in mountain environments and his most recent training took place about 1 year prior. These factors likely contributed to his poor judgment in choosing to continue the planned flight to a low altitude in a high-density altitude mountain environment despite the airplane's deficient rate of climb.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The inexperienced pilot's exceedance of the airplane's critical angle-of-attack during a turn at high density altitude, which resulted in an accelerated stall and impact with water. Contributing to the accident was the pilot's poor judgment to continue the flight despite the airplane's limited performance during the accident flight.

Findings

Aircraft	Angle of attack - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Personnel issues	Decision making/judgment - Pilot
Environmental issues	High density altitude - Effect on equipment
Environmental issues	(general) - Effect on operation
Environmental issues	Downdraft - Awareness of condition
Environmental issues	Downdraft - Effect on operation

Factual Information

History of Flight

Enroute-cruise	Other weather encounter (Defining event)
Initial climb	Loss of control in flight
Initial climb	Aerodynamic stall/spin

On June 7, 2020, about 0830 mountain daylight time, an experimental, amateur built Kitfox 1 airplane, N595KF, was destroyed when it was involved in an accident near Lander, Wyoming. The pilot was seriously injured, and the passenger was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to the pilot, he had transported the airplane by trailer from his home in Washington State to Wyoming to see friends and landmarks. The night before the accident, he checked the weather conditions and determined that high winds and turbulent conditions were forecasted for around noon the following day. On the morning of the accident, he moved the airplane to Hunt Field (LND), Lander, Wyoming, with a friend and unloaded the airplane from its trailer at 0700. After he verified no significant changes in the forecasted weather conditions, the pilot performed a preflight inspection of the airplane, gave his passenger a safety briefing and then departed uneventfully from LND, which is at a field elevation of 5,588 ft mean sea level (msl) about 0730.

The pilot reported that he flew near a cell phone tower that was located about 14 nm south of LND and then turned northwest towards Frye Lake, which was about 10 nm from the tower at an elevation of about 8,500 ft msl. He further stated that the airplane had been in a constant climb for most of the flight due to the high altitude. When they arrived at the lake, he flew northeast of the water and then decided to descend to 500 ft above ground level (agl) and fly over the lake before returning to LND. He circled the area momentarily while he descended to his desired altitude. As they flew over the lake, they encountered turbulence and "sinking air," which was followed by a sudden descent to a lower altitude. The pilot could not recall the precise altitude but remembered being about eye level with treetops. As the airplane approached the west side of the lake, the pilot advanced the throttle to full power to gain airspeed but was unable to transition the airplane into a climb. At this point, the pilot initiated a turn to the left to avoid impacting a group of recreational vehicles ahead of him and rising terrain to his right. Subsequently, the airplane entered a nose-down attitude and impacted the water.

According to multiple witnesses, the airplane came into view over the lake on a southwest heading. Witness observations indicated that the airplane was about 25 ft agl when it began to "wobble." The airplane then entered a climb, which was immediately followed by a steep left turn, and then a nose down dive. See Figure 1. According to the witnesses, the airplane impacted the water in a near vertical nose-down attitude and a fire ensued shortly after impact.

Witnesses also stated the airplane appeared to be affected by windy conditions that were present at the time of the accident.

The pilot reported that he normally flies near his home in Port Angeles, Washington (291 ft msl) and sometimes around Washington State, but seldom flies in mountain environments. According to the pilot, the day of the accident was the second time he had departed from a mountain environment. He had received some mountain flying instruction from a Certified Flight Instructor about one year prior to the accident and had read a book on the subject.

The airplane did not have a flight manual or performance charts. According to the pilot, the airplane had a normal climb rate of 700 fpm at sea level with a passenger, but he was only able to achieve a climb rate of about 300 fpm after he departed Lander, Wyoming. Additionally, the pilot had to make circles as he climbed before the airplane reached a safe altitude before reaching the mountain range.

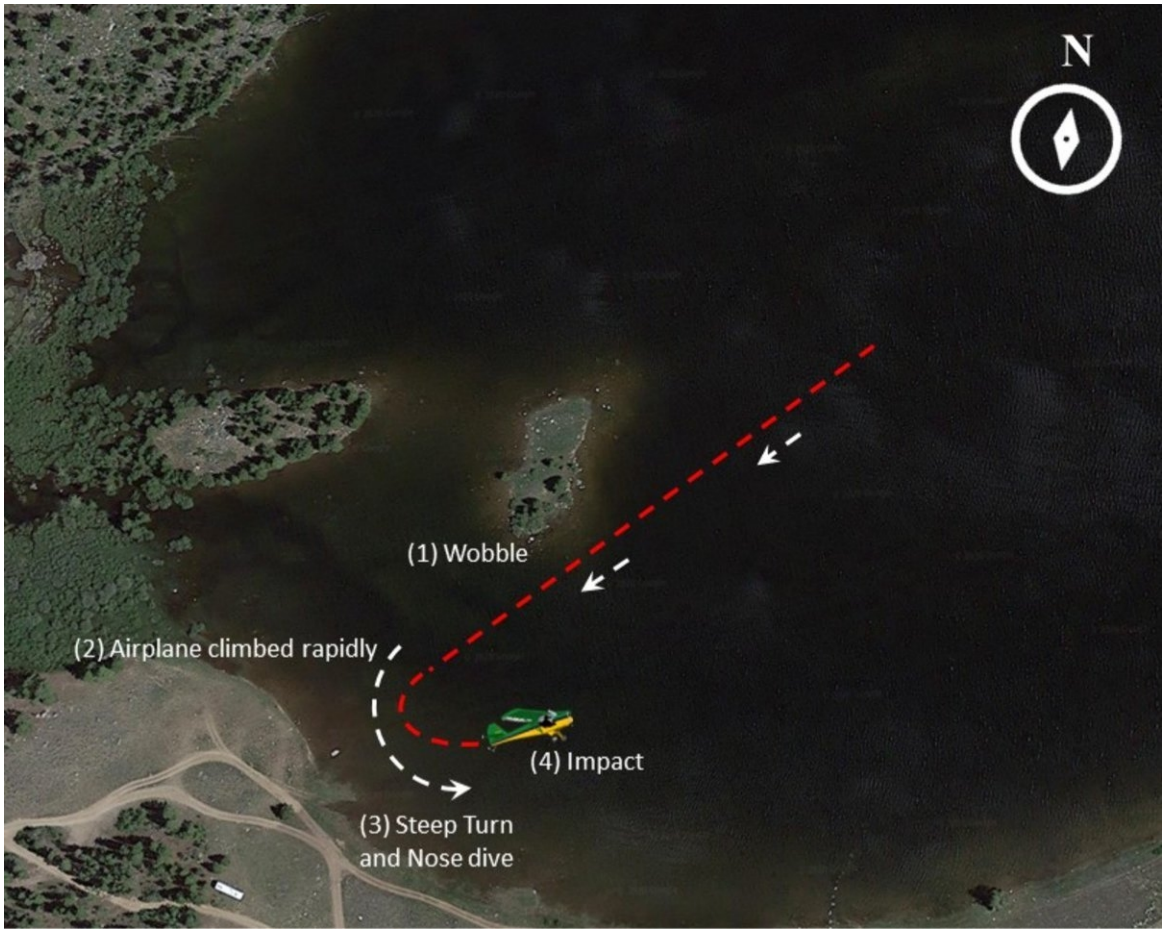

Figure 1: Witness Observations of the Airplane's Final Movements

Pilot Information

Certificate:	Sport Pilot	**Age:**	33,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	November 19, 2019
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	May 20, 2019
Flight Time:	139 hours (Total, all aircraft), 121 hours (Total, this make and model), 112 hours (Pilot In Command, all aircraft), 22 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Kitfox	**Registration:**	N595KF
Model/Series:	Kitfox	**Aircraft Category:**	Airplane
Year of Manufacture:	1995	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	190
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	December 14, 2019 Condition	**Certified Max Gross Wt.:**	950 lbs
Time Since Last Inspection:	24.4 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	633.2 Hrs at time of accident	**Engine Manufacturer:**	Rotax
ELT:	C91 installed	**Engine Model/Series:**	532UL
Registered Owner:	On file	**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LND,5588 ft msl	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:	07:53 Local	**Direction from Accident Site:**	45°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	30°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.71 inches Hg	**Temperature/Dew Point:**	12°C / 5°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lander, WY (LND)	**Type of Flight Plan Filed:**	None
Destination:	Lander, WY (LND)	**Type of Clearance:**	None
Departure Time:	07:30 Local	**Type of Airspace:**	Class G

Wind and Density Altitude

The weather study captured wind information from various sources about the time of the accident. A Remote Automated Weather Station (RAWS) located 3 nm from the accident site at 5,589 ft above ground level (agl), about 3,000 ft lower than the accident site elevation, indicated that the wind had shifted from the south at 5 kts to the northwest about 9 kts, with gusts to about 11 kts, at the time of the accident. Another site, located in South Pass City, Wyoming, 15 nm from the accident site, but approximately the same field elevation as the accident site, indicated winds from the west at 11 kts, gusting to 19 kts with a density altitude of 9,526 ft. The density altitude for the RAWS station could not be determined as the station did not capture station pressure.

A High-Resolution Rapid Refresh (HRRR) numerical model was completed to determine the state of the atmosphere over the accident site. The HRRR 0800 wind profile indicated a surface wind from the northwest at 6 kts with gusts to 18 kts. The density altitude was computed as 9,461 ft based on the surface temperature, dewpoint and relative humidity estimated by the HRRR 0800 model. The model further estimated that at 1,000 ft agl over the accident, the wind was from the northwest at 25 kts. According to the weather study, the HRRR wind profile and topography would result in rising air or updrafts on the southern side of the ridge 0.5 nm south of Frye Lake and downward flow or downdrafts over the lake. Further, the cooler temperatures of the lake would result in descending air over the lake.

Witness Statements

Four of the five witnesses observed that the airplane appeared to be affected by the wind conditions at the time of the accident. Further, one witness described that it was "windy" just prior to the accident" and another witness referenced updrafts, which can also imply downdrafts.

Weather Forecast

According to an Area Forecast Discussion issued at 0415 MDT on the day of the accident and valid for 24 hours starting at 0600 the day of the accident,

"Scattered to numerous showers and thunderstorms are expected this afternoon. Although brief MVFR/IFR conditions are possible in convection, VFR conditions are expected to prevail much of the time."

Terminal Aerodrome Forecasts (TAFs)

The TAF for LND from 0600 through 1000 forecasted variable wind at 5 kts, visibility of at least 6 statute miles with few clouds at 7,000 ft agl. The forecast expected thunderstorms in the vicinity after 1000.

Pilot's Weather Research

The pilot stated that he normally used windy.com and WingX on his electronic tablet for weather planning. The day before the accident, he reviewed the weather forecasts to determine if conditions would be more appropriate Sunday (the day of the accident) or Monday. He was unable to recall what research he performed as his tablet broke during the accident, but stated that he likely researched "prognostic charts, wind forecasts, METARs, TAFs, NOTAMS [Notices to Airmen], PIREPS [Pilot Reports], and SIGMETS '[Significant Meteorological Information]." The pilot reported that his research did not reveal any significant weather forecasted to take place during the accident flight. His review of wind conditions for Pinedale, Wyoming and LND revealed that wind conditions would become excessive by 1000 Sunday and Monday was forecasted to be too turbulent to fly. The pilot stated that he doesn't obtain a full briefing because it's too much information, so he reviews only wind and graphical charts. He normally prefers wind conditions to be below 10 kts on the surface to ensure a safe landing. The pilot re-reviewed the wind conditions at 0730 just before the accident, which indicated no significant changes from the night before.

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	42.704723,-108.882499

The airplane impacted Frye Lake and came to rest in a near vertical position about 200 ft from the shoreline at an elevation of about 8,517 ft msl. Photographs provided by first responders showed that cowling, cabin, and most of the fuselage were submerged while the aft section of fuselage and empennage were above the water. The left wing was partially submerged, and the right wing was completely submerged. Most of airplane was consumed by postcrash fire.

During a postaccident examination of the wreckage, flight control continuity was verified to all control surfaces and no anomalies were identified with the engine that would have precluded the normal production of power.

Additional Information

Mountain Flying

According to the Federal Aviation Administration (FAA), *Tips on Mountain Flying* (FAA-P-8740-60),

Winds

"Strong winds can cause some of the most dangerous conditions you'll have to contend with in the mountains. To minimize the chance of encountering dangerous turbulence, mountain flying should not be attempted if the winds aloft forecast at mountain top levels are greater than 25 knots. Above this level, potentially dangerous turbulence, as well as very strong up and downdrafts are likely."

Density Altitude

"Since increasing temperature makes air less dense, an airplane will perform as if it is at a higher altitude than on a colder day, given that the airplane is at the same height above sea level."

"…a normally aspirated engine will lose 3% of its power per thousand feet of density altitude increase. Next, as density altitude increases, the wings have less dense air with which to create lift. Since a propeller is an airfoil, it, too, will be less efficient.

"Higher density altitudes also affect best rate and angle of climb airspeeds. Best rate of climb IAS decreases as altitude increases, while best angle IAS increases slightly. Refer to your airplane's handbook to be sure you are flying the correct airspeed to get the performance you expect."

According to the FAA, *Mountain Flying* (AFS-850 17_04),

"True airspeed is approximately 2% higher than indicated airspeed for every thousand feet of altitude."

Accelerated Stall

"The most common accelerated stall procedure starts from straight-and-level flight at an airspeed at or below V_a. Roll the airplane into a coordinated, level-flight 45° turn and then smoothly, firmly, and progressively increase the AOA [angle of attack] through back elevator pressure until a stall occurs. Alternatively, roll the airplane into coordinated, level-flight 45° turn at an airspeed above V_a. After the airspeed reaches V_a, or at an airspeed 5 to 10 percent faster than the unaccelerated stall speed, progressively increases the AOA through back elevator pressure until a stall occurs."

"If the turn is coordinated at the time of the stall, the airplane's nose pitches away from the pilot just as it does in a wings level stall since both wings will tend to stall simultaneously. If the airplane is not properly coordinated at the time of the stall, the stall behavior may include a change in bank angle until the AOA has been reduced."

"Because they occur at higher-than-normal airspeeds or may occur at lower-than-anticipated pitch attitudes, they can surprise an inexperienced pilot."

Preventing Similar Accidents

Mastering Mountain Flying (SA-039)

The Problem

Pilots with limited or no training in mountain flying can be surprised about their aircraft's different performance at high density altitude, often leading to serious or fatal accidents. Wind and other weather phenomena interacting with mountainous terrain often lead unsuspecting pilots into situations that are beyond their capabilities.

Should a crash occur, a pilot who survives the crash but does not have emergency or survival gear immediately accessible may not survive the harsh environment until rescuers are able to reach the location.

What can you do?

Through training, pilots can develop skills and techniques that will allow them to safely fly in mountainous terrain. When planning flights in mountainous terrain, pilots and flight instructors should do the following to enhance safety:

- Flight instructors should encourage their students to attend a quality mountain flying course before attempting flight in mountainous terrain or at high density altitudes.
- Pilots should consult with local flight instructors before planning a flight into mountainous terrain. Even experienced mountain pilots may not be familiar with local conditions and procedures for safe operations.
- Pilots should be aware that weather interacting with mountainous terrain can cause dangerous wind, severe turbulence, and other conditions that may be unsafe for aircraft, especially light GA aircraft.
- Pilots should consider specialized emergency and survival equipment (such as personal locator beacons in addition to a 406 emergency locator transmitter) before flying in mountainous terrain, and develop a plan for immediate access to the equipment in the event of a postaccident fire.
- FBO staff should be alert for customers who appear to be planning flight into mountainous terrain who could benefit from mountain flying instruction.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-039.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Bruce Hanson; Federal Aviation Administration; Casper, WY
Original Publish Date:	June 2, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=101398